CLAIMS

What is claimed is:

1. A spatial light modulator comprising stacked layers of deformable electrode pairs supporting a deformable reflective surface, each electrode pair comprised in upper and lower stacked elongate ribbon conductors extending in respective orthogonal directions, each coincidence of an upper and lower electrode pair defining a pixel within the respective stacked layer, each electrode pair deforming to a maximum deformation in response to an applied write voltage across the pair so as to produce at the reflective layer a phase correction of the corresponding pixel proportional to the corresponding deformation.

2. The apparatus of Claim 1 wherein the maximum deformation of the pixels in each stacked layer is substantially the same, and wherein the maximum deformation of successive layers decreases in ascending order of the stacked layers.

3. The apparatus of Claim 1 wherein said maximum deformation decreases with successive ones of the stacked layers by ascending negative powers of 2, wherein a phase correction can be written to an individual one of

said pixels with n-bit accuracy, wherein n is the number of said layers.

4. The apparatus of Claim 1 wherein the lower ribbon conductors are mutually parallel in a first direction and coplanar in a first plane, and the upper ribbon conductors are mutually parallel in a second direction orthogonal to said first direction and coplanar in a second plane vertically displaced from said first plane.

5. The apparatus of Claim 2 wherein said reflective layer is supported on an exterior surface of an end one of said layers, said end layer being one of

(a) at the beginning,

(b) at the end

of said ascending order.

6. The apparatus of Claim 1 wherein each one of said layers further comprises elongate ribs between respective ones of the lower elongate ribbon conductors that are within said one layer, said ribs providing support to said upper elongate conductors to form therebetween a compression gap defining said maximum deformation.

7. The apparatus of Claim 6 wherein each one of said layers further

comprises a deformable membrane resting on top of said ribs and supporting the upper elongate ribbon conductors that are within said one layer.

8. The apparatus of Claim 7 wherein each of said layers further comprises a table supporting the lower ribbon conductors of the bottom one of said layers and an insulating layer between said table and said lower ribbon conductors of the bottom one of said layers.

9. The apparatus of Claim 7 wherein each one of said layers further comprises an insulating layer between said deformable membrane and said upper ribbon conductors.

10. The apparatus of Claim 7 wherein each one of said layers further comprises an insulating layer covering said lower elongate ribbon conductors.

11. The apparatus of Claim 10 wherein said elongate ribs are integrally formed with the insulating layer covering said lower elongate ribbon conductors.

12. The apparatus of Claim 11 further comprising an insulating layer covering said upper elongate ribbon conductors.

13. The apparatus of Claim 12 wherein each of said layers further

comprises a pedestal extending between said upper elongate ribbon conductors and the table of the layer immediately above said one layer.

14. The apparatus of Claim 13 wherein said pedestal is integrally formed with the insulating layer covering said upper elongate ribbon conductors.

15. The apparatus of Claim 14 wherein said table and said membrane of each layer comprises a semiconductor material and said upper and lower elongate ribbon conductors comprise a metal.

16. The apparatus of Claim 15 wherein said semiconductor material comprises instrinsic crystalline silicon and said insulating layers comprise silicon dioxide.

17. The apparatus of Claim 8, wherein the upper and lower elongate conductors are organized in rows and columns, respectively, that are in vertical registration, said apparatus further comprising:

a substrate, said substrate supporting the table of the bottom one of said layers;

a row encoder along one edge of said substrate having a number of row outputs equal to the number of the upper elongate ribbon conductors in a given one of said layers, each of said row outputs having a number of separate

bits equal to the number of said layers, each of said separate bits being connected to an upper elongate ribbon conductor in the corresponding layer; and

a column encoder along another edge of said substrate having a number of column outputs equal to the number of the lower elongate ribbon conductors in a given one of said layers, each of said column outputs having a number of separate bits equal to the number of said layers, each of said separate bits being connected to a lower elongate ribbon conductor in the corresponding layer.

18. The apparatus of Claim 17 further comprising respective variable D.C. bias voltage sources for respective ones of said layers, each variable D.C. bias voltage source having one terminal connected to all of the upper elongate ribbon conductors of the respective layer and an opposite terminal connected to all of the lower elongate ribbon conductors of the respective layer.

19. The apparatus of Claim 18 wherein each of said variable bias voltage sources is set to a voltage level that sets the compression gaps of said layer to the requisite fraction of a wavelength of light to be reflected by said reflective layer.

20. The apparatus of Claim 1 further comprising a pattern of voids cut out of each of said upper and lower elongate ribbon conductors to enable flexing

thereof.

21. A spatial light modulator having n-bit phase resolution and comprising n electrically compressible layers of NxN pixels, each of said layers comprising N row electrodes in an upper thin film and N column electrodes in a lower thin film and insulated from said N row electrodes, each of said pixels constituting an intersection in respective planes of the row and column electrodes, the pixels of respective layers being in vertical registration, at least one of said row and column electrodes being deformable in response to an applied voltage therebetween, supporting structure separating said column and row electrodes from one another, said supporting structure leaving vertical compression gaps at each pixel between said row and column electrodes through which at least one of said row and column electrode can deform toward the other in response to the applied voltage, the pixels of adjacent layers being coupled together whereby deformations of overlying ones of said pixels are cumulative.

22. The apparatus of Claim 21 wherein the compression gaps within a given one of said layers are of the same height and wherein the compression gaps of successive layers decrease in accordance with a numerical progression.

23. The apparatus of Claim 22 wherein said numerical progression

comprises ascending negative powers of a base number.

24. The apparatus of Claim 22 further comprising an optically reflective coating on an external surface of an end one of said layers.

25. The apparatus of Claim 23 wherein said base number is two and said numerical progression comprises successive fractions of a wavelength of a lightbeam reflected by said reflective coating.

26. The apparatus of Claim 21 further comprising n variable bias voltage sources for adjusting the compression gaps of respective ones of said layers in accordance with the wavelength of a light beam to be modulated.

27. The apparatus of Claim 21 further comprising:

a row encoder having N outputs, each of said N outputs having n bits connected to overlying row electrodes of said n layers; and

a column encoder having N outputs, each of said N outputs having n bits connected to overlying column electrodes of said n layers.

28. A spatial light modulator having vertically arranged planar layers, each layer comprising a planar array of vertically displaced electrode pairs that are electrically addressable by row and column, and electrode separation ribs

establishing a void between the electrodes of each pair, said void having a height defining a compression gap of said layer through which electrode pairs are deformable, electrode pairs of adjacent layers being in vertical registration and being coupled whereby deformations of pixels in vertical registration are cumulative.

29. The apparatus of Claim 28 wherein the compression gaps of successive layers are determined in accordance with successive fractions of a wavelength of a light beam to be modulated.